UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MASSACHUSETTS

SINGULAR COMPUTING LLC, Plaintiff, v. GOOGLE LLC, Defendant.	Civil Action No. 1:19-cv-12551 FDS Hon. F. Dennis Saylor IV

DEFENDANT GOOGLE LLC'S REPLY
TO PLAINTIFF'S CLAIM CONSTRUCTION BRIEF

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I. INTRODUCTION

Singular's claim construction arguments run afoul of both the intrinsic evidence and the law. As Google pointed out in its preliminary brief, the asserted patents fail to provide reasonably clear boundaries for the claim term "repeated execution" because there is no way to know how many executions to perform as a benchmark for evaluating infringement. Rather than confront this problem, Singular insists that the Court should delay ruling because of unidentified factual disputes, never explaining why the limited record necessary to decide this dispositive issue is insufficient. And on the merits, Singular improperly asks the Court to apply an outdated standard of indefiniteness.

Similarly, Singular's arguments regarding the term "low precision high dynamic range execution unit" are inconsistent with numerous embodiments in the specification. In arguing that execution units require a memory circuit, Singular would limit the claims to a single embodiment in the patent despite the existence of other disclosed embodiments, in violation of established claim construction principles. Singular also argues that the phrase provides no limitation on the claims beyond what is provided for in other, subsequent limitations in each claim; however, this would render the phrase "low precision high dynamic range" superfluous.

Finally, Singular's response to Google's proposed construction of "first input signal representing a first numerical value" as "a digital and/or analog representation of a value that the LPHDR execution unit operates on" is also flawed. Singular objects that the claimed LPHDR execution unit operates on signals instead of values; however, this argument runs counter to both the claims and the specification, which state that the LPHDR execution unit operates on values. Singular also incorrectly asserts that Google, by proposing a construction that encompasses analog embodiments disclosed in the specification, impermissibly imports a limitation into the asserted claims. Singular's argument turns claim construction principles on their head: both the claim language and the specification make clear that both analog and digital embodiments are within the scope of the claims, and it is Singular's argument that would improperly limit the claims to a single embodiment (just as it seeks to do with the term "execution unit").

For these reasons, discussed further below, Google respectfully requests that the Court find the asserted claims indefinite or, alternatively, adopt Google's proposed constructions.

II. ARGUMENT

A. "Repeated execution"

Singular does not dispute that finding the phrase "repeated execution" indefinite will resolve the case. Singular nonetheless insists the Court defer ruling until summary judgment (or even trial). Singular Preliminary Br. (ECF No. 112) at 15-16. There is no procedural reason to do so here. And on the merits, Singular's defense that "repeated execution" is definite because it is not ambiguous rests on a legal standard that the Supreme Court has expressly rejected.

1. The Court can and should rule on indefiniteness now.

"Indefiniteness is a matter of claim construction, and the same principles that generally govern claim construction are applicable to determining whether allegedly indefinite claim language is subject to construction." *Praxair, Inc. v. ATMI, Inc.*, 543 F.3d 1306, 1319 (Fed. Cir. 2008), *abrogated on other grounds by Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901 (2014). Accordingly, district courts routinely hold that "[i]ndefiniteness is a question of law resolvable during claim construction." *MyMedicalRecords, Inc. v. Walgreen Co.,* No. 2:13-CV-00631 ODW (SHx), 2014 WL 7338822, at *2 (C.D. Cal. Dec. 22, 2014).1 And, relatedly, the Federal Circuit has affirmed the entry of judgment based on indefiniteness findings made during claim construction. *E.g., Romala Stone, Inc. v. Home Depot U.S.A., Inc.,* No. 1:04-CV-2307-RWS, 2007 WL 2904110, at *6 (N.D. Ga. Oct. 1, 2007) ("[T]he Court finds that the issue of invalidity based upon indefiniteness can be addressed without the necessity of requiring additional discovery."), *aff'd*, 392 F. App'x 875 (Fed. Cir. 2010); *see also HZNP Medicines LLC v. Actavis*

[1] *See also, e.g.*, *Lufthansa Technik AG v. Astronics Advanced Elec. Sys. Corp.*, 196 F. Supp. 3d 1190, 1196 (W.D. Wash. 2016) (rejecting "attempt to relitigate the issue of indefiniteness" decided during claim construction), *aff'd on other grounds*, 711 F. App'x 638 (Fed. Cir. 2017); *Mycone Dental Supply Co. v. Creative Nail Design, Inc.*, No. 11-4380 (JBS/KMW), 2014 WL 3362364, at *4 (D.N.J. July 9, 2014) ("*Nautilus* affects an ultimate issue in the case and, because indefiniteness is a significant issue to be adjudicated at claim construction, *Nautilus* impacts the *Markman* proceedings.").

Labs. UT, Inc., 940 F.3d 680, 687–99 (Fed. Cir. 2019) (affirming finding of indefiniteness in claim construction order).

Resolving indefiniteness during claim construction also makes practical sense. Deferring the issue effectively "require[s] . . . a new round of claim construction," a result that "does not appear to be efficient or even entirely sensible." *DataTern, Inc. v. MicroStrategy, Inc.*, No. 11-11970-FDS, 2017 WL 1147441, at *5 (D. Mass. Mar. 27, 2017). In this case, the lack of efficiency would be significant. As Singular would have it, the parties must complete fact discovery (which the parties have agreed will involve up to 16 depositions per side), expert discovery, and summary judgment briefing before the Court can rule on a narrow dispositive issue.

In urging delay, Singular cites no persuasive authority for its claim that courts are "generally . . . reluctant" to decide indefiniteness before summary judgment. Singular Preliminary Br. at 16 (quoting *Junker v. Med. Components, Inc.*, No. 13-4606, 2017 WL 4922291, at *2 (E.D. Pa. Oct. 31, 2017)). That broad language comes from a single unpublished decision that relied on just two other unpublished decisions, *Junker*, 2017 WL 4922291, at *2, even while acknowledging contrary authority, *id.* at *2 n.1. To the extent that decision and others suggest that a ruling's "dispositive effect" is in itself a reason for delay, *Int'l Dev. LLC v. Richmond*, No. 09-2495 (GEB), 2010 WL 4703779, at *7 (D.N.J. Nov. 12, 2010), they are unpersuasive and contrary to the Court's invitation to identify issues that may expedite resolution of the case, ECF No. 70 at 5.

By contrast, Singular's other rationale for delay is inapplicable here because Google's indefiniteness argument does not raise "numerous factual issues" (which, tellingly, Singular fails to identify). Singular Preliminary Br. at 15. Instead, Google's argument rests on three simple predicates:

- "[t]he phrase 'repeated execution' supplies the claimed test for measuring whether the LPHDR execution units' operation is sufficiently different from exact mathematical calculations to satisfy the claimed minimum percentage of inaccuracy";
- "[t]he asserted patents include analog embodiments"; and

- "[a]nalog signals are subject to a phenomenon known as 'noise,'" which guarantees that "analog systems cannot generate repeatable results when executing a given operation on a particular input." Google Preliminary Br. (ECF No. 111) at 6-7.

These three predicates require no fact-finding on any disputable issue. The first two predicates—the role of "repeated execution" within the claim language and the patents' embrace of analog embodiments—are based on the claim language and specification and thus call only for "a determination of law." *Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 331 (2015). And the third predicate—analog systems' inability to generate repeatable results—is a law of nature, not a "question about the state of the knowledge of a skilled artisan" that can reasonably be disputed. *See* Singular Preliminary Br. at 15 (quoting *Dow Chem. Co. v. Nova Chems. Corp. (Canada)*, 809 F.3d 1223, 1225 (Fed. Cir. 2015). The asserted patents themselves admit that analog operations yield non-repeatable results, noting that prior art analog devices "introduce noise into their computations, so the computations are not repeatable." '273 patent at 4:12-13. Singular thus ***could not have*** disputed this fact, even if it had timely provided an expert opinion purporting to do so. *E.g.*, *Smith & Nephew, Inc. v. Rea*, 721 F.3d 1371, 1380 n.6 (Fed. Cir. 2013) ("Expert opinions that are contrary to admissions in the specification do not create a factual issue.").[2] In short, there are no factual disputes and Google has met its burden of proving the underlying facts by "clear and convincing evidence." Singular Preliminary Br. at 4.

2. Singular's only attempt to engage on the merits misstates the standard for finding indefiniteness.

Singular's lone argument on the merits of indefiniteness—that "'repeated execution' is not an arcane term of art, nor is it ambiguous"—ignores the governing standard for indefiniteness in favor of a rejected one. Singular Preliminary Br. at 15. Even before *Nautilus*, the Federal Circuit held that regardless of whether "a claim term's definition can be reduced to words, the claim is

[2] To the extent Singular seeks to justify its failure to provide an expert declaration by complaining that Google failed to disclose its indefiniteness argument, *see* Singular Preliminary Br. at 15, Singular's position is baseless. After Google provided the disclosures required by the Court's Scheduling Order and Local Rules, Singular never asked for the basis of Google's position.

still indefinite if a person of ordinary skill in the art cannot translate the definition into meaningfully precise claim scope." *Halliburton Energy Servs., Inc. v. M-I LLC*, 514 F.3d 1244, 1251 (Fed. Cir. 2008). And *Nautilus* decisively rejected the notion that a claim's scope is reasonably clear so long as the claim is not ambiguous or is amenable to construction. *Nautilus*, 572 U.S. at 911 (2014).

Singular thus flatly misstates the applicable standard when it asserts that "[a] claim is not indefinite as long as its meaning is 'discernible.'" Singular Preliminary Br. at 5 (quoting *Ossur SF Össur Ams., Inc. v. iWalk, Inc.*, No. 12-11061-FDS, 2013 WL 4046709, at *7 (D. Mass. Aug. 8, 2013)). That pre-*Nautilus* standard of indefiniteness is no longer good law—as the Federal Circuit has expressly held. *Compare Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 1375 (Fed. Cir. 2001) (holding claim is not indefinite if meaning is "discernible"), *with Dow Chem.*, 803 F.3d at 1225-26 (holding *Nautilus* abrogated *Exxon*'s discernibility standard).

The "repeated execution" term at issue here illustrates well *Nautilus*'s distinction between the ability to define a claim term and the ability to put reasonably clear boundaries on that term. As Google noted in its preliminary brief, "'repeated' certainly ***means*** 'more than one.'" Google Preliminary Br. at 8 (emphasis added). But that definition alone cannot provide reasonably clear boundaries on the invention's scope because the asserted patents' benchmark for infringement still rests on an unknown and unknowable number of repeated executions, each of which could yield different results. *Id.* at 8-11; '273 patent at 4:12-13. That situation—where different potential testing leads to different results—is the quintessential example of indefiniteness. Google Preliminary Br. at 6-7; *see also, e.g.*, *Otsuka Pharm. Co., Ltd. v. Torrent Pharms. Co., Ltd.*, 151 F. Supp. 3d 525, 548–49 (D.N.J. 2015).

B. "LPHDR execution unit"

Although the parties agree that the "LPHDR execution unit"/"execution unit" is a "processing element" that performs arithmetic, the parties' competing constructions of "LPHDR execution unit"/"execution unit" differ in two key respects. In both instances, Singular would have the Court re-write the claims in violation of black letter law. ***First***, Singular's construction of

"execution unit" would erase the words "low precision high dynamic range," which are fundamental to each asserted claim. ***Second***, although it would be inconsistent with both the claim language and the specification, Singular would require that an "execution unit" be "paired with a memory circuit." For the reasons discussed below, only Google's proposed construction stays true to the claim language in light of the specification.[3]

1. Singular would improperly read "low precision high dynamic range" out of the claims.

Singular's proposed construction reads out the words "low precision" and "high dynamic range." Singular argues that these terms are "clearly defined in the asserted claims," referring to subsequent claim limitations directed to specific dynamic ranges and error levels. Singular Preliminary Br. at 9. But if that were the case, the adjective phrase "low precision high dynamic range" ("LPHDR") that describes the "execution unit" serves no purpose, and the claim could have just said "execution unit" with no such modifying language. Such a result is disfavored. *See Power Mosfet Techs., L.L.C. v. Siemens AG*, 378 F.3d 1396, 1410 (Fed. Cir. 2004) ("[I]nterpretations that render some portion of the claim language superfluous are disfavored."). Consistent with basic canons of claim construction, LPHDR is presumed to have a meaning independent of the rest of the claim. Here, subsequent claim limitations regarding error rates and dynamic ranges may narrow the scope of what "low precision" and "high dynamic range" mean in general, but those ranges do not render LPHDR entirely superfluous, as Singular argues they do. Put another way, "LPHDR" describes a genus of execution units; that genus has different species with different dynamic ranges and error rates. *Compare* '273 patent claim 1 (claiming a dynamic range of "1/65,000 through 65,000" and error rates of "at least Y = 0.05%" for "at least . . . 5% of the possible valid inputs") *with* claim 53 (claiming a dynamic range of "1/1,000,000 through 1,000,000" and the same error rates).

[3] The parties also disagree about whether the execution unit operates on input signals vs. values. *See* Singular Preliminary Br. 10-11. That topic is addressed below in relation to Google's proposal for the term "first input signal representing a first numerical value." *See infra* Section II.A.1.

2. The patents do not require memory to be paired with execution units.

The second point of contention regarding this term—whether execution units ***must*** be paired with memory—boils down to another instance of Singular attempting to limit the claims to a particular embodiment. As Google conceded in its opening brief, memory ***may*** be paired with execution units consistent with the claims and specification here. *See* Google Preliminary Br. at 15. But the patents do not ***require*** such a pairing, as Singular's claim construction would.

Singular's construction conflicts with the claim language itself. As Google noted in its preliminary brief, none of the asserted claims refer to memory, nor do any of the patents use the phrase "memory circuit." *Id.* at 15-16. Thus, Singular's attempt to read in that limitation finds no support in the claims. More importantly, Singular's argument actually conflicts with the claims: dependent claims not asserted here ***do*** reference LPHDR execution units that "include" memory. These limitations make clear, under the doctrine of claim differentiation, that LPHDR execution units as claimed in the independent claims, cannot be ***required*** to be "paired with a memory circuit," as Singular now claims. For instance, dependent claim 25 of the '273 patent, which is not asserted, introduces the following limitation: "The device of claim 1 . . . wherein the device includes memory locally accessible to at least one of the LPHDR execution units . . . ." And the doctrine of claim differentiation is at its "strongest" where, as here, the limitation that is sought to be "read into" an independent claim (i.e., memory) appears in a dependent claim. *See Sunrace Roots Enter. Co. v. SRAM Corp.*, 336 F.3d 1298, 1302–03 (Fed. Cir. 2003). Notably, Singular did not address these dependent claims in its preliminary brief.

But the flaws in Singular's construction do not stop there. Singular relies on two citations to the specification to support its argument. In both instances, Singular tries to pass off a ***single*** embodiment as the ***only*** possible embodiment. In fact, as explained below, the patent clearly contemplates and identifies embodiments that are ***not*** paired with memory. Constructions that exclude embodiments disclosed in the specification are strongly disfavored. *See, e.g.*, *Oatey Co. v. IPS Corp.*, 514 F.3d 1271, 1276–77 (Fed. Cir. 2008) ("We normally do not interpret claim terms in a way that excludes embodiments disclosed in the specification.").

Singular first relies on the following description of an embodiment in the specification: "we call each unit, which pairs memory with arithmetic, a Processing Element or 'PE.'" '273 patent at 16:54-56. Singular Preliminary Br. at 6 (emphasis added). But the '273 patent could not be clearer that this is not true of ***every*** embodiment. To start, the introductory clause of the sentence cited by Singular clarifies that it is "[f]or purposes of discussion below," *id.*, while embodiments identified earlier in the patent are ***not*** "paired with memory." For instance, earlier in the same paragraph cited by Singular, the patent notes that the invention ***could be*** used in implementations with "***shared memory*** designs," which differ from the one-to-one "pair[ing]" that Singular relies on. '273 patent at 16:49 (emphasis added). The specification also discloses another implementation of the invention: "a computer including a processor and other components (***such as memory coupled to the processor by a data path***), wherein the processor includes components for performing LPHDR operations in any of the ways disclosed herein, is an example of an embodiment of the present invention." *Id.* at 29:5-13 (emphasis added). Singular's argument that memory is a ***necessary*** component of the LPHDR execution unit does not square with this description of memory as an ***optional*** component. Moreover, the description of "memory coupled . . . by a data path" with a processor is different from the idea of a memory circuit "paired with" an arithmetic circuit, which Singular claims is inherent in the invention described in the patents. *Id.* at 29:7-8, *see* also Singular Preliminary Br. at 6.

Yet another embodiment, the software embodiment identified in the specification, presents a clear counterexample to Singular's interpretation. The specification states that "any of the techniques described above may be implemented, for example, in hardware, software tangibly stored on a computer-readable medium, firmware, or any combination thereof." *Id.* at 29:16-19. Yet *software* tangibly stored on a computer-readable medium cannot include a *memory circuit,* because software is *computer code* while a memory circuit is *hardware*. In other words, if Singular's construction is adopted, it would improperly exclude the software embodiment explicitly identified in the specification. *See, e.g.*, *Oatey Co.*, 514 F.3d at 1276–77.

Singular's second authority on this score is Figure 4, which Singular describes as "show[ing] that the exemplary execution unit ('processing element') comprises memory circuits and arithmetic circuits." Singular Preliminary Br. at 7. The key word here is "exemplary." The specification identifies Figure 4 as "an example design for a Processing Element." '273 patent at 2:52-53. As stated, Google does not dispute that the execution units described in the patents ***may*** be combined with memory, but Singular offers no support for the notion that a memory circuit is ***required*** in all embodiments, a position that is belied by the intrinsic record discussed above.

Singular also relies on a lone piece of extrinsic evidence to support its construction. Namely, Singular points to a treatise on computer architecture by David Patterson that describes the Pixel Visual Core ("PVC"), a processor for mobile devices. Patterson explains that the PVC contains "a two-dimensional array of independent processing elements (PEs), each of which contains 2 16-bit ALUs, 1 16-bit MAC unit, 10 16-bit registers, and 10 1-bit predicate registers." ECF No. 112-5. Singular takes this example beyond its logical limits, arguing that the treatise "describes 'processing elements' as having memory registers." Singular Preliminary Br. at 8. To the contrary, the treatise describes ***the PVC's*** processing elements as having memory registers; it does not purport to describe processing elements in general. That is consistent with Google's position, which is that a processing element *may,* but need not always, be combined with a memory circuit.

In fact, other treatises offer more general descriptions of processing elements. Contrary to Singular's position, these texts identify processing elements ***without*** memory. For instance, *DSP*

8.4.1 Processing Elements

Processing elements (*PEs*) usually perform simple, memoryless mappings of the input values to a single output value. The arithmetic operations commonly used in DSP algorithms are

Add/sub, add/sub-and-shift
Multiply, multiply-and-accumulate
Vector product
Two-port adaptor
Butterfly

We will reserve the more general term *processor* to denote a PE with its internal memory and control circuitry. Hence, a processor is able to perform a task independently of other processors.

Integrated Circuits (1999) defines "processing elements (PEs)" as generally "memoryless." It contrasts PEs with the "more general term processor," which refers to a PE with memory:

See Declaration of Andrew Bruns in Support of Google's Reply to Plaintiff's Claim Construction Brief ("Bruns Decl."), Ex. A, Lars Wanhammer, *DSP Integrated Circuits* (1999), at 366.

In short, Singular's proposed construction conflicts with both the intrinsic and extrinsic evidence of the meaning of "LPHDR execution unit." Accordingly, for the reasons discussed above and in Google's opening brief, the Court should adopt Google's construction of this term.

C. "First input signal representing a first numerical value"

Google has proposed the following construction of "first input signal representing a first numerical value": "A digital and/or analog representation of a value that the LPHDR execution unit operates on." That proposed construction provides a straightforward, but necessary, clarification to the asserted patents' claim language—namely that the "numerical value" represented by the "first input signal" (whether that signal is analog, digital, or some combination of the two) is the same "numerical value" that the LPHDR execution unit uses to execute its "first operation." Singular raises two objections to this construction. ***First***, it asserts that the claim language specifies that the LPHDR execution unit operates on "input signals," not "numerical values." ***Second***, Singular objects that the proposed construction impermissibly rewrites the claim language to encompass analog input signals. Neither objection has merit.

1. The claim language and specification clarify that the LPHDR execution unit operates on values, not signals.

Singular's pronouncement that the asserted claims recite a LPHDR execution unit that performs operations on "signals," not "values," purportedly rests on the claim language, which recites a LPHDR execution unit "adapted to execute a first operation on a first input signal representing a first numerical value." '273 patent, claim 1. But Singular's argument is myopic, ignoring the context of the claim language as well as detailed descriptions in the specification, which clarify that the claimed LPHDR execution unit operates on values, not signals.

To begin, Google's proposed construction is consistent with the claim language. Indeed, it harmonizes the claim structure by identifying "***a*** numerical value" represented by "a first input signal" sent to the claimed LPHDR execution unit as the antecedent basis for the asserted claims' subsequent reference to "***the*** possible valid inputs" to the operation performed by the unit. '273 patent at 30:4. In contrast, Singular's interpretation of LPHDR execution units as operating on signals instead of values muddles the antecedent basis for "the possible valid inputs," suggesting it is "a first input signal" instead of the numerical value the signal represents. '273 patent at 30:1-4. That interpretation does not square with the claim language, which confirms that "the possible valid inputs" are values, not signals. Google Preliminary Br. at 19. That is, the claim language identifies "the dynamic range of the possible valid inputs" (as distinguished from input *signals*). '273 patent at 30:4. And the dynamic range recited by the claim language refers to a range of numerical values.

Tellingly, Singular offers no explanation of how a "dynamic range" could possibly refer to a "signal," even though this would be the effect of its claim construction. As just one example, one of the asserted claims describes "the dynamic range of the possible valid inputs to the first operation" as being "at least as wide as from 1/1,000,000 through 1,000,000." '273 patent, claim 18. That is a recitation of values. But whereas a "numerical value" can be "at least as wide as from 1/1,000,000 through 1,000,000," a signal cannot, absent an identification of the appropriate unit of measurement, which the claim language does not contain. Thus, if, as the specification describes, an input signal can take the form of "charges, currents, voltages, frequencies, pulse widths, pulse densities, [or] various forms of spikes," a person of reasonable skill would have no way of knowing how to determine if a particular signal satisfies the dynamic range limitation, which would render the claims indefinite. *Id.* at 14:19-20.

A simplified example will clarify this point. Take a digital embodiment of the alleged invention designed to perform an operation that doubled whatever it received as an input. Assuming the embodiment operated on digital input signals, it might receive a series of electrical impulses of high ("1") and low ("0") voltages that represented 0010—the binary equivalent of "2."

Gottschalk v. Benson, 409 U.S. 63, 65–66 (1972); *see also Chamberlain Grp., Inc. v. Lear Corp.*, 516 F.3d 1331, 1335 (Fed. Cir. 2008) (describing how digital computers "use low and high voltages to manipulate, transmit, receive, and store vast amounts of data"). Google's proposed construction makes it easy to apply the claim language to this example. The series of electrical impulses is the "first input signal." '273 patent at 30:1. That signal "represent[s] . . . a first numerical value" of 2. *Id.* at 30:1-2. The numerical value of 2 would be one of many "valid inputs" to the doubling operation because it falls within the specified dynamic range (*e.g.* 1/1,000,000 through 1,000,000). *Id.* at 30:4. In contrast, any interpretation that construes "a first input signal" as the antecedent basis for "the possible valid inputs" renders the claim language nonsensical by making it unclear how to measure that signal's dynamic range (*e.g.* by the voltage of the signal, its frequency, its pulse width, its pulse densities, etc.).

In addition to the claim language, the specification confirms that the "possible valid inputs" to the operations performed by LPHDR execution units are values and not signals. For example, when describing "an example digital implementation of the LPHDR arithmetic unit," the specification details how the multiplier and divider in the unit "are implemented as circuits that simply add or subtract their inputs, ***which are two's complement binary numbers***." '273 patent at 12:50-51, 13:23-25 (emphasis added). Elsewhere, the specification discusses the results when using "certain specific ***input values***" in arithmetic operations performed on a LPHDR execution unit. *Id.* at 26:46-47 (emphasis added). The specification also details an embodiment where "the LPHDR elements each accept a set of ***inputs*** drawn from a range of valid ***values***, and for each specific set of ***input values*** the LPHDR elements each produce one or more output values." *Id.* at 27:35-37 (emphases added).

Furthermore, construing the asserted claims as reciting a LPHDR execution unit operating on values is the only way to square the claim language with the specification. In fact, the specification clarifies that LPHDR execution units operate on ***values***, not the input signals representing them:

The LPHDR arithmetic unit . . . performs LPHDR arithmetic operations . . . . The

> input, output, and intermediate "***values***" received by, output by, ***and operated on*** by the [unit] . . . may, for example, take the form of electrical signals representing numerical values.

'273 patent at 10:63-67.

Moreover, any construction that interpreted the asserted claims as reciting a LPHDR execution unit that operated on *signals* would exclude most—if not all—of the embodiments disclosed in the specification, a consideration that weighs heavily against adopting that construction. *See Oatey Co.*, 514 F.3d at 1276–77.

The specification explicitly states that the embodiments of the alleged invention operate on numerical values, not signals. As the first sentence of the specification's summary states:

> Embodiments of the present invention are directed to a processor or other device . . . which includes processing elements ***designed to perform arithmetic operations*** (possibly but not necessarily including, for example, one or more of addition, multiplication, subtraction, and division) ***on numerical values*** of low precision but high dynamic range . . . .

'273 patent at 2:9-18 (emphases added); *see also id.*, Abstract. Similarly, the specification discloses that "implementations may vary in the dynamic range of the space of ***values they process***. For example, in certain embodiments, a LPHDR arithmetic element ***processes values*** . . . ." *Id.* at 27:6-10 (emphases added).

Singular's assertion that the alleged invention instead operates on signals isn't consistent with the specification's descriptions of how comparable computer chips and processors generally operate. The specification consistently—and repeatedly—describes computer chips as performing operations and computations on numerical values. *See, e.g.*, *id.* at 3:8-18 ("[C]onventional CPU chip[s] . . . . perform[] . . . arithmetic with integers . . . and . . . floating point numbers."); *id.* at 4:32-45 (describing how "Field Programmable Gate Arrays" perform "arithmetic operations such as multiplication and division on integers, and . . . on floating point numbers").

Singular's assertion that the LPHDR execution units operate on signals is also inconsistent with the allegations in its own First Amended Complaint, which describe the units as operating on values. *See, e.g.*, Dkt. 37, ¶ 35 ("Execution by the LPHDR execution unit . . . of an operation on an input numerical value will produce an output numerical value."); *id.*, ¶ 46a (describing LPHDR

execution units as "manipulating numbers"); *id.*, ¶ 85 (detailing how LPHDR execution units generate results "in response to requests to perform arithmetic operations on high dynamic range numbers"); *id.* ¶ 90c (alleging that accused product infringes because, among other things, it "is adapted to execute a multiplication operation on a value"). Accordingly, the Court should adopt Google's proposed construction.

2. Google's proposed construction does not import any limitations.

Singular also contends that Google's proposed construction of "a first input signal representing a first numerical value" impermissibly imports an "analog" limitation into the claim language. Singular Preliminary Br. at 14. But Singular has it backwards. Google's proposed construction does not, in any way, limit the scope of the asserted claims. Google's construction clarifies that "a first input signal" might represent a numerical value in digital form, analog form, or some combination of the two. And the specification only describes embodiments that operate on digital and/or analog representations. Google Preliminary Br. at 16. Tellingly, Singular cannot identify any embodiment that this portion of Google's proposed construction would ***exclude*** from the asserted claims (or, conversely, an embodiment the construction would include that the claim language expressly excludes). As a result, Google's construction does not run afoul of any of the legal authority Singular cites, which applies to constructions that ***exclude*** embodiments described in the specification. *See, e.g.*, *Resonate Inc. v. Alteon Websystems, Inc.*, 338 F.3d 1360, 1364–65 (Fed. Cir. 2003).

If anything, it is Singular that attempts to artificially limit the scope of the asserted claims. Singular, for example, takes issue with Google's proposed construction because it includes analog embodiments within its scope. *See* Singular Preliminary Br. at 14. And Singular seemingly wants to exclude analog embodiments because those embodiments raise indefiniteness concerns, for the reasons described *supra* at 2-5. But the fact that the specification describes both digital and analog embodiments, and Google's proposed construction also includes both digital and analog embodiments, favors adopting Google's construction. *See, e.g.*, *Oatey Co.*, 514 F.3d at 1276–77.

Furthermore, adopting a construction that excludes analog embodiments would render other parts the claim language superfluous. As discussed in Google's preliminary brief, the asserted claims recite a LPHDR unit that, after "repeated execution" of a calculation, produces results that differ, by a certain degree, from the results of an exact mathematical calculation. Google Preliminary Br. at 7-8. Based on Singular's First Amended Complaint, however, the "repeated execution" language is superfluous for a digital embodiment. *See* Dkt. 37, ¶¶ 94, 111, 129. "Repeated execution" of the operation in question is only relevant for analog systems, which are susceptible to "noise" that can cause the system to generate different results for the same inputs. Google Preliminary Br. at 7. As a result, if the alleged claims only encompass digital systems—as Singular implies—there would be no reason to require "repeated execution" of an operation by the LPHDR execution unit. Accordingly, the Court should adopt Google's proposed construction, which encompasses both the digital and analog embodiments disclosed in the specification and thereby also gives meaning to the "repeated execution" claim language. *See Power Mosfet Techs., L.L.C.*, 378 F.3d at 1410.

III. CONCLUSION

For the foregoing reasons, and for those raised in Google's opening brief, Google respectfully requests that the Court find that the term "repeated execution" and, by extension, the asserted patents, are indefinite. In the alternative, Google respectfully requests that the Court adopt Google's proposed constructions for "low precision high dynamic range execution unit" and "first input signal representing a first numerical value."

Respectfully submitted,

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CERTIFICATE OF SERVICE

I certify that this document is being filed through the Court's electronic filing system, which serves counsel for other parties who are registered participants as identified on the Notice of Electronic Filing (NEF). Any counsel for other parties who are not registered participants are being served by first class mail on the date of electronic filing.

/s/ Nathan Speed
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